

What is claimed is:

1. A semiconductor module mountable on an external heat sink, said semiconductor module comprising:

5           an insulating substrate for said semiconductor module, said insulating substrate including a substrate, a first conductive pattern formed on a first main surface of said substrate which is on the opposite side from said external heat sink, and a second conductive pattern formed on a second main surface of said substrate which is on the same side as said external heat sink and for contact with said external heat sink; and

10           a mounting frame made of metal and having a mounting surface for contact with said external heat sink, said mounting frame including a flange along a periphery thereof for engagement with a peripheral part of said insulating substrate at said first main surface, said flange pressing said peripheral part of said insulating substrate toward said external heat sink to force said insulating substrate into pressure contact with said external heat sink.

15           2. The semiconductor module according to claim 1,

wherein said mounting frame further includes:

a first metal plate having said mounting surface; and

20           a second metal plate disposed on said first metal plate and having a protrusion along a periphery thereof projecting from a periphery of said first metal plate to define said flange.

25           3. The semiconductor module according to claim 2,

wherein the thickness of said first metal plate is equal to the sum of the

thickness of said substrate and the thickness of said second conductive pattern; and  
wherein the thickness of said second metal plate is equal to the thickness of said  
first metal plate.

5           4. The semiconductor module according to claim 2,  
              wherein said insulating substrate further includes a third conductive pattern  
              formed on said first main surface along a periphery of said substrate; and  
              wherein said flange and said insulating substrate contact each other, with said  
              third conductive pattern therebetween.

10           5. The semiconductor module according to claim 4,  
              wherein said third conductive pattern is formed partially to allow part of said  
              flange to contact said third conductive pattern; and  
              wherein said mounting frame and said insulating substrate are bonded to each  
              other with an adhesive filling a gap between part of said flange which is out of contact  
              with said third conductive pattern and said first main surface.

15           6. The semiconductor module according to claim 1,  
              wherein said insulating substrate further includes a third conductive pattern  
              formed on said first main surface along a periphery of said substrate; and  
              wherein said flange and said insulating substrate contact each other, with said  
              third conductive pattern therebetween.

20           7. The semiconductor module according to claim 6,  
              wherein said third conductive pattern is formed partially to allow part of said

flange to contact said third conductive pattern; and

wherein said mounting frame and said insulating substrate are bonded to each other with an adhesive filling a gap between part of said flange which is out of contact with said third conductive pattern and said first main surface.

5

8. The semiconductor module according to claim 1,

wherein said substrate, said first conductive pattern and said second conductive pattern of said insulating substrate have respective peripheries in alignment with each other; and

10 wherein said flange presses said periphery of said first conductive pattern toward said external heat sink, with an insulative material between said flange and said first conductive pattern.

9. The semiconductor module according to claim 1, further comprising:

15 a semiconductor device mounted on said first conductive pattern;

a cylindrical case disposed on a main surface of said mounting frame which is on the opposite side from said external heat sink;

said case, said mounting frame and said insulating substrate defining a space surrounding said semiconductor device; and

20 an insulative sealing material filling said space.

10. The semiconductor module according to claim 9,

wherein said sealing material is a thermosetting resin.

25

11. An insulating ~~substrate~~ for a semiconductor module, said insulating

substrate comprising a mounting surface, said mounting surface being adapted to be forced into pressure contact with an external heat sink by a mounting frame pressing a peripheral part of said insulating substrate,

5           said insulating substrate having a curved configuration in which a peripheral part of said mounting surface warps upwardly away from said external heat sink above a central part of said mounting surface.

12. The insulating substrate according to claim 11, further comprising:

10           a substrate;  
a first conductive pattern formed on a first main surface of said substrate which  
is on the opposite side from said external heat sink; and  
a second conductive pattern formed on a second main surface of said substrate  
which is on the same side as said external heat sink and having a bottom surface serving  
as said mounting surface,  
15           wherein all of said substrate, said first conductive pattern and said second  
conductive pattern are curved.

13. The insulating substrate according to claim 11, further comprising:

20           a substrate;  
a first conductive pattern formed on a first main surface of said substrate which  
is on the opposite side from said external heat sink; and  
a second conductive pattern formed on a second main surface of said substrate  
which is on the same side as said external heat sink and having a bottom surface serving  
as said mounting surface,  
25           wherein only the bottom surface of said second conductive pattern is curved

*Sabatay*

because of a difference in thickness between a central part of said second conductive pattern and a peripheral part thereof.

ada  
a57